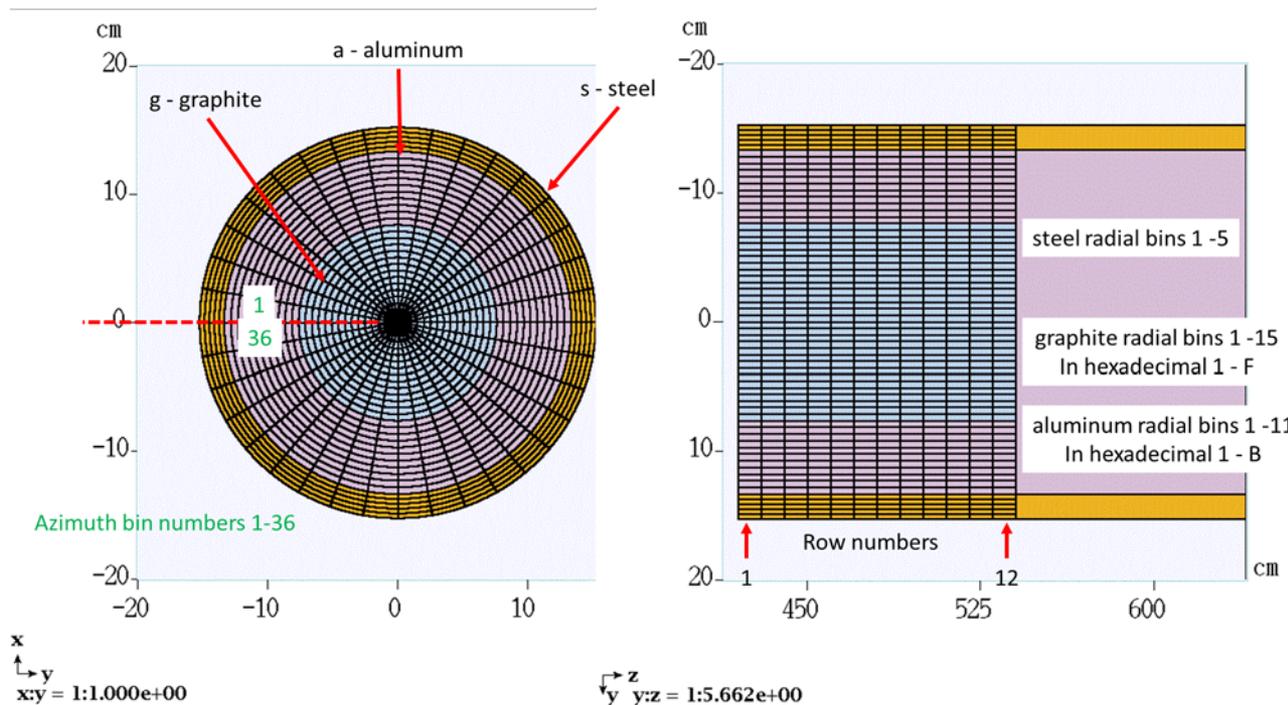


# g-2 beam dump thermal analysis

K. Ammigan  
03/28/16

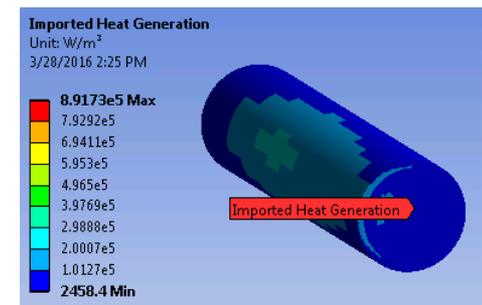
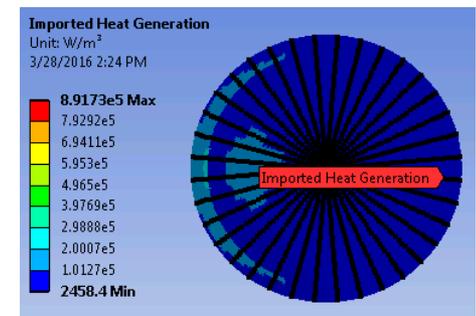
# MARS energy deposition data

- Performed by A. Leveling
- Energy deposition data provided for first 119.4 cm of beam dump
  - Graphite blocks
  - Aluminum core
  - Steel jacket
- For more details, refer to document # 3670-v1 uploaded to g-2 DocDB on 03/21/16

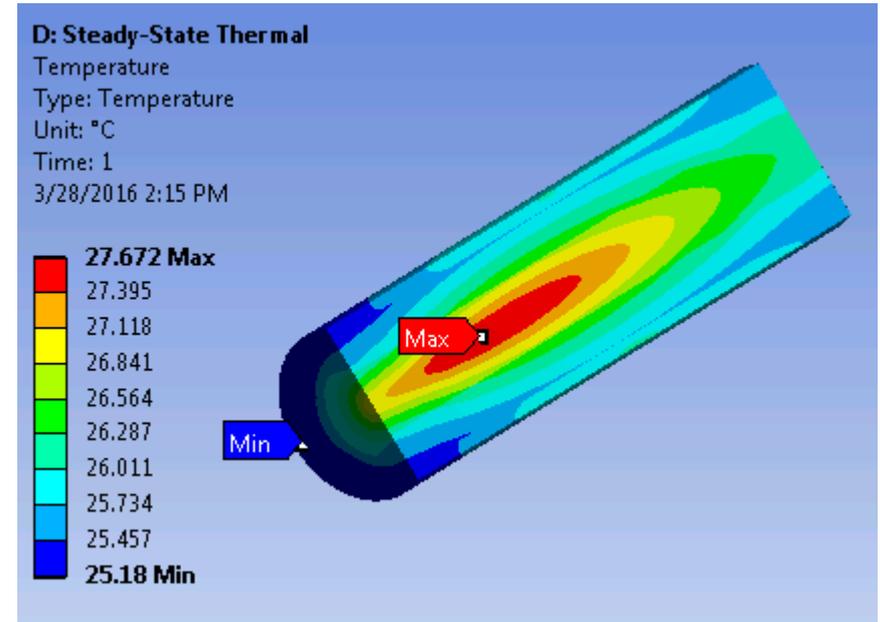
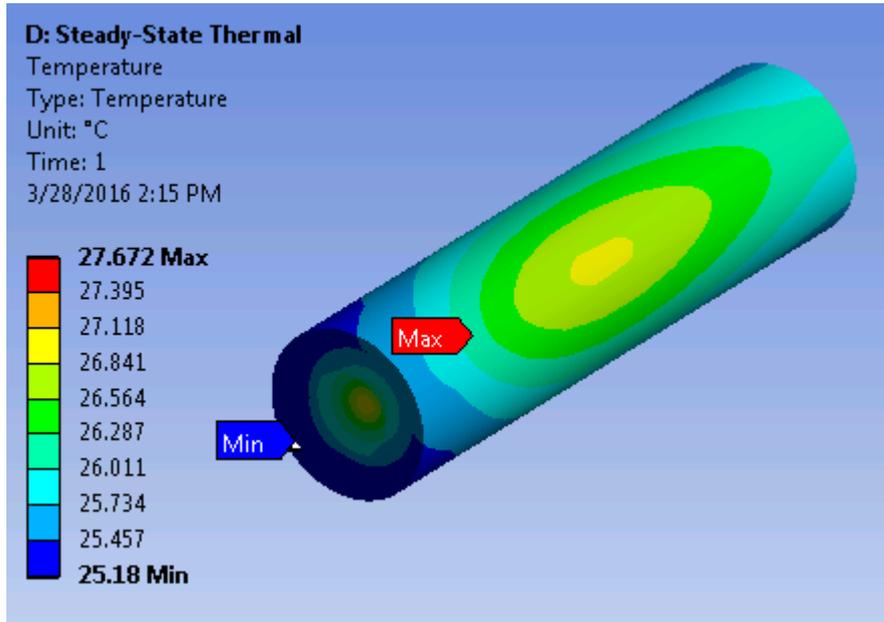


# ANSYS thermal analysis model

- 3D Steady State analysis using time averaged MARS energy deposition data
  - Based on  $1.25 \times 10^{13}$  pps
- Room temperature material properties
  - Graphite (POCO TM grade)
  - Aluminum (Al 6061)
  - Steel (A36)
- Thermal gap conductance (M.M. Yovanovich)
  - Graphite to Aluminum:  $6000 \text{ W/m}^2\text{K}$
  - Aluminum to Steel:  $4500 \text{ W/m}^2\text{K}$
- Initial temperature:  $25 \text{ }^\circ\text{C}$
- Convective heat transfer applied on surface of Aluminum core
  - Calculated to be  $\sim 3840 \text{ W/m}^2\text{K}$ 
    - Based on single tube water flow
- Geometry
  - Graphite OD: 15.24 cm
  - Aluminum OD: 26.70 cm
  - Steel OD: 30.48 cm
  - Length: 119.4 cm



# Steady State temperature profile

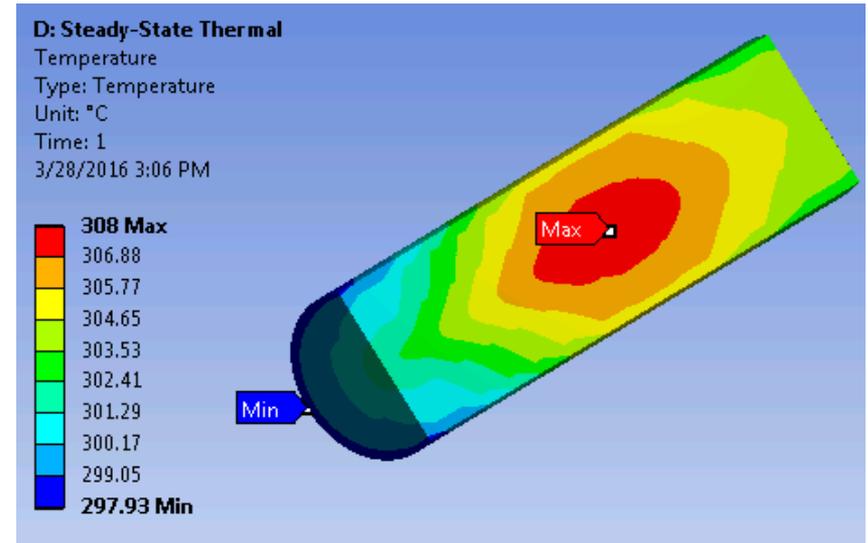
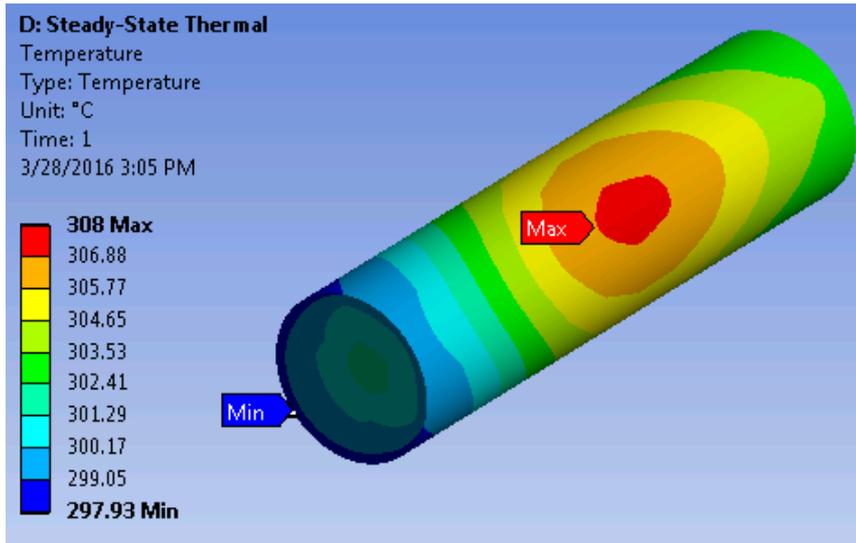


- Peak temperature ~ 27.7 °C
- Total heat deposition: 2.12 kW (only in first 119.4 cm of the beam dump)

# Temperature profile - No water cooling case

- Assumed free convection on outer steel surface
  - Stagnant air around horizontal cylinder

Temperature [°C]	Convection Coefficient [W/m <sup>2</sup> ·°C]
1.	1.24
10.	2.67
100.	5.76
200.	7.25
300.	8.3
500.	9.84
700.	11.01
1000.	12.4



- Peak temperature ~ 308 °C